

Section of Odontology

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The Problem of "The Clicking Jaw"

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It is not many years since the treatment of lesions of the temporo-mandibular joint was regarded as the exclusive province of general and orthopædic surgeons. A growing appreciation in recent years of the importance of dental factors in the ætiology of many of these conditions is at last resulting in the direction of these cases to the dental surgeon.

In many of the American publications on this subject the emphasis has been on the auditory symptoms which are believed to result from lesions of the temporo-mandibular joint. In my experience cases in which there are auditory symptoms are rare. The only cases encountered so far have been undoubted examples of otosclerosis. The purpose of this paper is to consider more closely the symptoms which definitely accompany disorders of the temporo-mandibular joint, in an endeavour to show the mechanism of their production and indicate a rational approach to their prevention and treatment.

SYMPTOMATOLOGY AND CLINICAL FINDINGS

In a series of consecutive cases the patients may be grouped according to their presenting symptoms, as follows:

- (1) Painless clicking during the opening phase.
- (2) Intermittent "locking" during which the opening is temporarily limited to about one fingerbreadth and usually accompanied by pain.
- (3) Limitation of opening with pain with a history of previous symptoms.
- (4) Limitation of opening with pain without previous symptoms.
- (5) Clicking, or more accurately jolting, at maximum opening and again at the beginning of the closing phase.
- (6) A combination of (1) or (2) with (5).

A typical patient in the first group is in the late teens or early twenties, with a history that the clicking began suddenly and spontaneously, or that it came on after some injury. The noise is quite often loud and may be audible to others as well as to the patient. It usually occurs when the mouth is about half-way open, but it may occur anywhere from quite early to almost the end of the opening movement. The patient is aware of a feeling of obstruction during the movement of opening, the click occurring as the obstruction is overcome. The rest of the opening movement and the whole of the closing movement are free of symptoms. Careful palpation or auscultation over the joint reveals that in addition to the loud noise during opening there is a faint click during the final 2 or 3 mm. of the closing movement.

In the majority of cases there is a deep over-bite resembling that of Angle's Class II Division 2. Very often some or all of the molars have been lost. In some cases with apparently well-formed dental arches, the first molars have been lost early to obviate crowding, and this

appears to be responsible for the deep over-bite. Sometimes there is a single dental factor such as a misplaced tooth, in an otherwise normal dental arch, which prevents the teeth coming together into their normal occlusal relationship. In nearly all except these last instances the free-way space is larger than normal. The term free-way space denotes the difference between the intermaxillary distance in the incisor region when the mandible is in the rest position and when the teeth are in occlusion.

Radiographically, the condylar head appears to be posterior to its normal position and there is a backward movement of the condyle as the mandible moves from the rest position into the position of occlusion (Figs. 1 and 2).

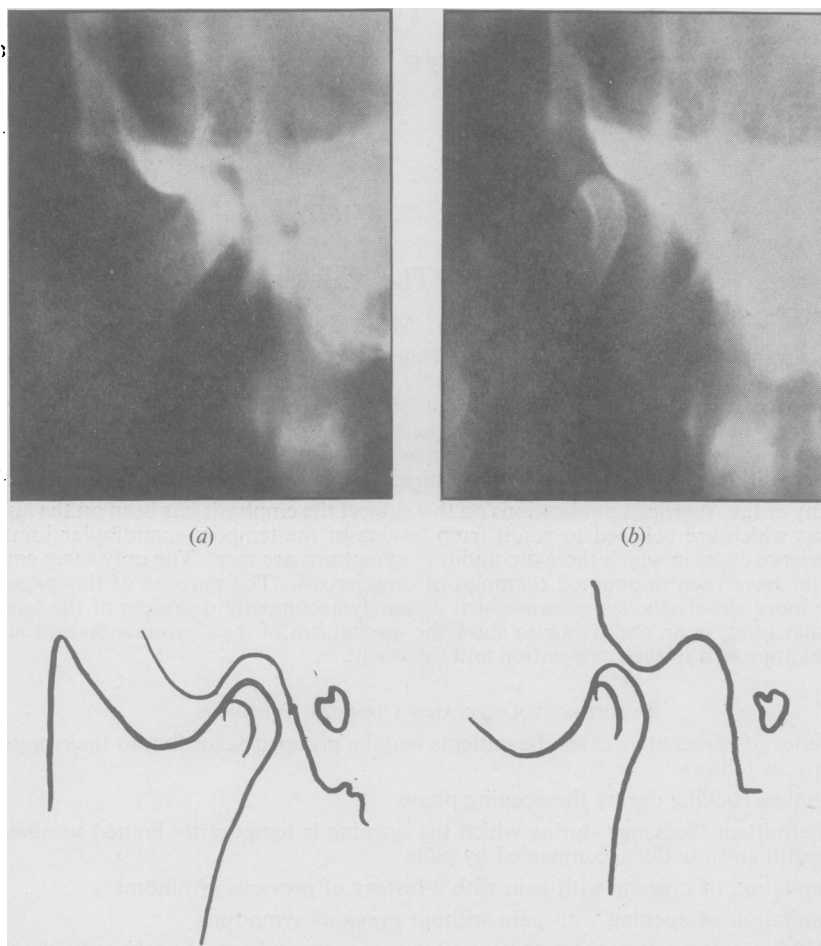


FIG. 1.—Tomographic sagittal sections (with tracings) of a normal temporo-mandibular joint showing the relationship of the condylar head to the articular eminence in (a) the closed, (b) the open positions.

A striking clinical feature of this type of case is that if the teeth are prevented from coming into occlusion by placing something between them, as by a thin rod held across the upper arch in the canine region, the clicking is eliminated.

Cases of this kind are not always free from pain. When the clicking has been present for a long time, and especially in women of neurotic type, pain over the area of the joint may be a feature. Occasionally some pain is present from the onset of clicking or it may even precede it.

A patient of the second group presenting himself for the first time complains that the jaw becomes locked, usually on waking, and for a time the mouth can only be opened a few millimetres. He has severe pain over the affected joint which is made worse by attempts to open the mouth wider. By making some manoeuvre of the jaw, often by pressure over the

joint, the patient is able to "unlock" the jaw and restore normal movement. The pain and tenderness persist for a time. In nearly all cases there is a history of clicking of the affected joint and when examined while the jaw is free the clinical findings are identical with those of the first group. The change in symptoms sometimes appears to have been spontaneous but more often there is a history of some trauma though this may have been slight. A slight blow on the chin; attempting to take a very large bite of a hard apple, "the free gratification of an inclination to yawn or sneeze", as Pringle (1918) puts it, may have brought about the change. Quite often there is a history of a recent dental extraction. This need not necessarily have been a difficult extraction of a lower molar, though that may well be the precipitating factor. On the contrary, when only one or two molars are in occlusion the loss of an upper molar may have a profound effect on jaw function, and precipitate symptoms.

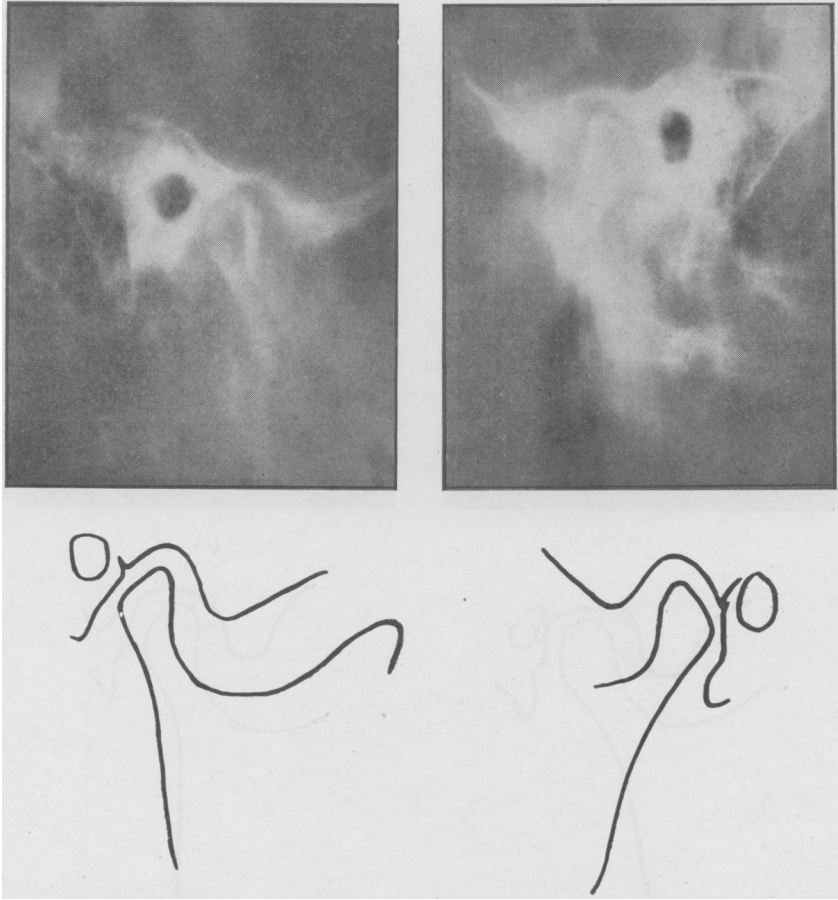


FIG. 2.—Note the backward displacement of both condyles in a typical case of painless clicking. Both sides are shown in the closed position.

A patient of the third group seen within a few days of the onset of symptoms complains of continuous aching pain centred over the affected joint radiating down to the angle of the jaw, and often also to the side of the head and to the ear, and occasionally to the mastoid region. The opening of the mouth is limited to about one fingerbreadth which makes eating difficult as well as painful. Usually there is a history of painless clicking for some months or years with recent episodes of temporary "locking" which have become more frequent, and increasingly difficult to "unlock". On the last occasion the usual manœuvre, by which the patient was previously able to "unlock" the jaw, failed. Examination reveals tenderness over the joint and often hyperæsthesia over the temporal and parotid regions. The limited opening, which no longer causes any clicking, is accompanied by deviation of the mandible to the affected side. Lateral movement of the mandible to the opposite side is limited and

increases the pain, while lateral movement towards the affected joint is usually full and without pain. Clearly there is an obstruction to the forward gliding movement of the condyle on the affected side. Careful observation of the teeth as they come into occlusion may reveal that this is accompanied by a lateral movement.

X-rays (Fig. 3) show that the condyle, posteriorly displaced when the teeth are in occlusion, as in Group 1 cases, does not move forward when the mouth is opened. It sometimes descends vertically for a short distance, the joint space remaining appreciably wider than normal.

It is evident from the foregoing that the symptoms of the first three groups correspond to the first, second and third stages of the same underlying process. Together they constitute what will be called Type I cases. It should be pointed out that although Type I cases usually go through all three stages they occasionally start at the second or even at the third. In this latter event it will be very difficult to distinguish the case from one belonging to the next group—Group 4.

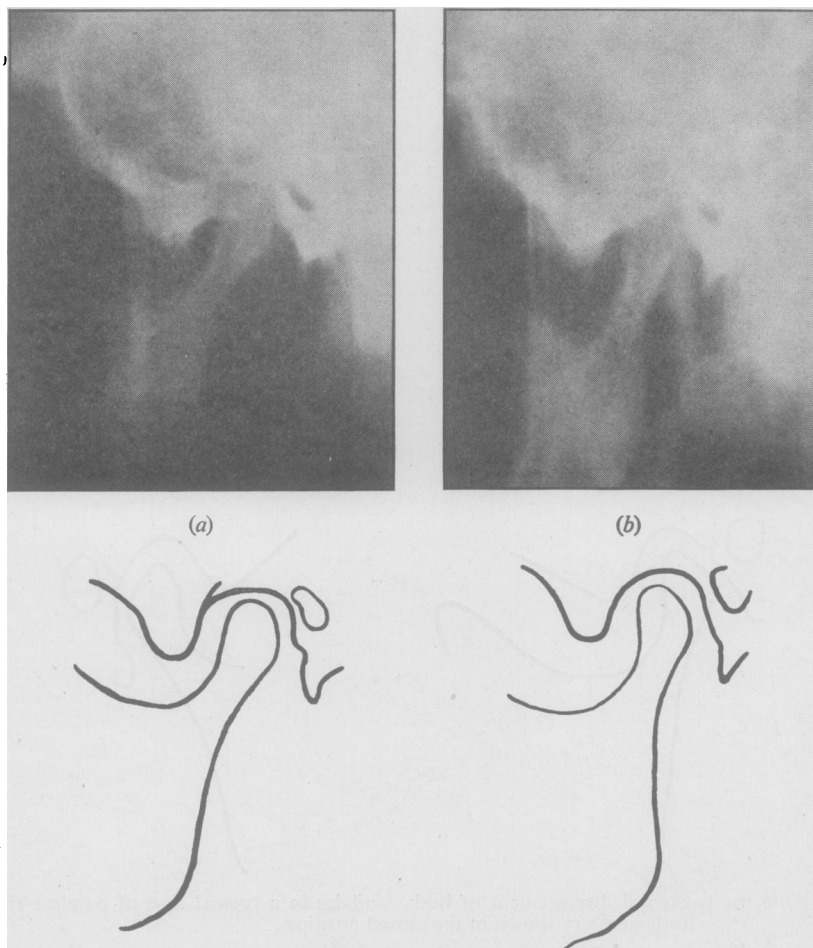


FIG. 3.—This patient had painful limitation of movement. Tomograms show absence of forward gliding of the condyle; (a) shows the closed and (b) the open position.

Symptomatically, Group 4 cases are very similar to those of Group 3 but they are usually distinguishable by the absence of a history of clicking and by the absence of abnormalities of either teeth or jaws. Except for the limited forward gliding of the condyle on the affected side and some widening of the joint space there is no radiographic abnormality.

The pain (which is severe) is sudden in onset, usually while eating or it may follow a severe blow on the jaw. There may be slight swelling over the affected joint. Another distinctive feature of the Group 4 cases is the tendency to settle down spontaneously after a few weeks, leaving no abnormality.

Patients of the fifth group experience what must be described as a jolt of the mandible, sometimes accompanied by a noise which is more of a hollow knock than a click, just as maximal opening is reached and again as the closing movement commences. It is usually bilateral and the "jolts" on the two sides are not quite synchronous, but follow one another in rapid succession so that the mandible is seen to perform a small jerk to one side and then back to the mid-line. The simple test which eliminates clicking in the Type I case is without effect. Pain is not usually a feature of these cases and many patients are unaware that their jaw movement is abnormal. Radiographically, they are indistinguishable from the normal in which the condylar head rides well on to the antero-inferior surface of the articular eminence when the mouth is fully open.

The fourth and fifth groups are thus clinically distinct from each other and from the Type I cases and will be called Types II and III respectively.

The sixth group has been included because cases in which the symptoms of either the first or second group are combined with those of the fifth are not uncommon. However, they possess most of the clinical features of the Type I case and run a similar course. The original six groups may thus be arranged as follows (*see table*):

| | | |
|---|-----------|-----------------|
| 1. Painless clicking during opening phase .. | 1st stage | } Type I |
| 2. Intermittent "locking" | 2nd stage | |
| 3. Limitation of opening with pain with history of previous symptoms. . . . | 3rd stage | |
| 4. Limitation of opening with pain without history of previous symptoms. . . . | | Type II |
| 5. Click or jolt occurring at maximum opening and again as closing phase begins | | Type III |
| 6. Combination of 5 with 1 or 2 | | Types III and I |

THE MECHANISM OF CLICKING

Before considering the mechanism by which the symptoms are produced it will be helpful to note certain structural features of the joint. In its simplest terms the temporo-mandibular articulation is a hinge joint in a movable socket; the fibro-cartilaginous disc is attached very firmly to the condyle at its poles so that normally it follows the condyle in all its movements and allows only a simple hinge movement to occur in the lower compartment of the joint.

The upper surface of the disc articulates with the postero-inferior surface of the articular eminence. It is only the thin central part of the disc which is concerned in withstanding such pressure as is transmitted to the joint during biting and chewing. Behind and above this thin central part the disc is thickened and softer, forming a cap on the condyle. Behind this thickening the disc thins rapidly and is blended with the capsule. Below and anterior to the thin central part there is another less well-marked thickening of the disc to which part of the lateral pterygoid muscle is inserted through the capsule. The capsule allows considerable free forward gliding movement in the upper joint compartment during which the condyle rides not only on to the summit of the eminence but often some distance on to its antero-inferior aspect. Some rotation of the condyle about its vertical axis and some lateral movement, the Bennett movement, is also possible.

The normal movement in opening the mouth is brought about by a combination of hinge movement in the lower compartment and forward gliding in the upper. It has been shown by Thompson (1946) that the movement of the mandible from the position of occlusion to the rest position is a pure hinge movement. Beyond this point gliding movement is increasingly evident, becoming predominant as maximal opening is approached. During closure this order is reversed and again the mandible passes from the rest position to the occlusal position by a pure hinge movement.

It is important to view the articulation of the mandible with the base of the skull as a single entity. Not only are there the two mandibular joints coupled together, but the two complexes also articulate through the teeth attached to them. When the mouth is open the mandibular joints and muscles and ligaments attached to the mandible, as well as the force of gravity, determine the position and path of movement of the mandible. When the teeth are in contact, they, as it were, dictate the position of the mandible.

Because of the mutual effect of the articulation of the teeth and the mandibular joints during development a high degree of harmony normally results, so that when the mandible moves from the rest position to the occlusal position the teeth meet exactly in their correct relationship. It will readily be seen that conflict between the "needs" of the joints and the "dictates" of the dental articulation may arise. Thus pain caused by biting on the gum flap over an erupting wisdom tooth may compel the patient to adopt a "bite of comfort" in which the teeth are brought together with the mandible deviated to one side. An over-erupted upper wisdom tooth, when the lower is missing, may impinge on the distal aspect of the

lower second molar and cause a forced lateral deviation of the mandible to the opposite side each time the teeth are brought into occlusion.

Loss of posterior teeth may allow the bite to close and cause the mandible as a whole to be forced in a backward direction by the action of the inclined planes of the incisors. Since the rest position of the mandible is virtually constant this closing of the bite results in an increase in the free-way space, and the movement of the mandible from the rest position to the occlusal position is no longer a pure hinge movement. The condyles are driven into a position above and behind their normal position in relation to the articular eminence. Only one condyle is affected when a unilateral cause is responsible, but when the bite has closed, both are affected.

This forced displacement of the condyle occurs each time the teeth are brought together in biting and chewing. If growth and development of the condyle and teeth have not ceased compensatory changes may occur to restore harmony. The fact that only a small proportion of people who have lost posterior teeth develop joint symptoms, suggests that such compensatory changes frequently occur. If only a single tooth or perhaps two teeth are responsible for the forced movement, the conflict may be resolved by the loosening of these teeth and the appearance of localized paradental disease. When the teeth do not give way and compensatory changes cannot occur, the condyle is forced into the abnormal position hundreds of times a day and the structures of the joint are subjected to a constantly recurring strain. In patients who grind their teeth during sleep, there is no respite for the joint.

The joint itself must be regarded as an important link in the proprioceptive mechanism co-ordinating the action of the muscles of mastication. Any disturbance of the joint is therefore likely to interfere with muscular co-ordination and cause abnormal forces to be transmitted to the joint. This will tend to perpetuate and even increase the joint disturbance. The use of only anterior teeth also imposes an added load on the joint.

As in other joints prolonged excessive stress and altered mechanics of the joint ultimately cause degenerative changes. In the temporo-mandibular joint this leads to loosening of the attachments of the disc to the condyle. Only a slight injury, which would be quite without effect on the normal joint, is then needed to start the train of symptoms described in the Type I case.

With the attachment of the disc to condyle thus loosened the disc is no longer compelled to follow the condyle when it moves into its abnormal position, so that during the final few millimetres of the closing movement the thickened upper part of the disc rotates forward to lie between the condyle and the postero-inferior surface of the eminence. This movement of the disc causes the faint click heard during this movement. In some people it is actually possible to feel what is certainly the edge of the disc being thrust laterally and forwards when this occurs.

When the mouth is opened the normal relationship of the condyle and disc is not immediately restored but the disc and condyle move together, both pulled by the lateral pterygoid, for a variable distance on to the postero-inferior surface of the articular eminence when pressure on the thick part of the disc and tension on its posterior attachment to the capsule causes the disc to slip back with a snap into its correct position on the condyle. Thereafter during the rest of the opening phase and all but the last two or three millimetres of the closing phase, the condyle and disc maintain their correct relationship. If this final two or three millimetres of the closing movement is prevented, the relationship of the condyle and disc is not disturbed and both opening and closing movements are free from clicking. This is, of course, what happens in the simple clinical test mentioned earlier, and in treatment the aim is to provide some permanent means of preventing the abnormal final part of the closing movement.

Once the disc has been sufficiently loosened from the condyle for clicking to occur the possibility of further damage to the joint is greatly increased. Not only is the posterior part of the disc subjected to pressure which it is ill-fitted to withstand, but the disc and condyle undergo additional trauma each time the click is produced. These factors alone may be enough to cause a low-grade traumatic arthritis in the joint. Further loosening of the disc increases the difficulty of restoring the correct relationship of the disc to the condyle, after displacement, which inevitably leads to the symptoms of intermittent locking, the thick upper part of disc remaining temporarily in front of the condyle acting as an obstruction to its forward movement.

It is a short step to the third stage where the locking has become permanent. The disc is then no longer a gliding socket for the condyle and even the hinge movement occurs in an abnormal socket ill-fitted for such a purpose. This represents a severe disturbance of the mechanism of the joint; not only will it give rise to pain in and around the joint, and to reflex pain particularly in the area of distribution of the auriculo-temporal nerve which supplies the joint, but limitation of movement of the one joint will impose a severe additional burden on the other, which ultimately may also give rise to symptoms. The low-grade

inflammatory process due to the constant trauma to the soft tissues of the disorganized joint may also ultimately give rise to bony changes in the condyle. Clinically, the picture will then be one of osteoarthritis.

What happens in Type II where painful limitation of opening starts suddenly while eating, without previous symptoms, can only be guessed; perhaps as a result of some unguarded unco-ordinated movement the disc gets severely nipped in some way, or more likely, as Professor Rushton has suggested to me, a villus of the synovial lining gets nipped in the joint. If there has been a severe blow on the jaw the explanation is simple. Clinically, the result in any case is an acute traumatic arthritis with an effusion into the joint cavity or cavities. It has already been noted that in this type and in the painful stage of Type I, the mandible may make a lateral movement as the teeth come into occlusion. This must not be confused with the lateral movement caused by a misplaced tooth. The effusion and œdema of the soft tissues within the joint have caused some separation of the joint surfaces and shifted the axis of rotation of the mandible. In other words the lateral movement is a manifestation of the lesion in the joint, not as in the other instance, its cause. It is clearly important to recognize this distinction and avoid the error of grinding the teeth to make them harmonize with the temporarily deranged joint. With rest the condition tends to settle down and return to normal.

In Type III the condition may be regarded as a subluxation of the joint. The condyle moves well beyond the summit of the articular eminence, but instead of doing so smoothly, as in many normal cases where the condyle reaches this point, it does so with a jerk. A similar jerk occurs when the condyle passes the summit of the eminence during closure. During the opening movement the elevator action of the muscles seems to be insufficiently inhibited, and the pull of the lateral pterygoid too strong; while in the closing movement the elevator parts act strongly before the retracting parts of the muscles have brought the condyle behind the summit of the eminence. Clearly a very high degree of co-ordination of muscle action is necessary to accomplish this part of the movement smoothly. A relatively slight injury, such as may be caused by dislocation during a dental extraction under general anæsthesia, may well upset the delicate neuromuscular mechanism and start this jerky movement.

It must here be mentioned in passing that some people can produce an impressively loud snap or click in their temporo-mandibular joints voluntarily. The mechanism by which this is done is very similar to that in the type under consideration, except that the muscular inco-ordination is deliberate. The mouth is opened wide so that the condyle is a little in front of the eminence. The elevator parts of the muscles are then made to act strongly a little before their retracting effect is brought into play. In this way the condylar head is made to spring back as soon as it reaches the summit of the eminence.

Reverting to the involuntary condition, here again the abnormal movement is itself injurious to the structures of the joint and tends to perpetuate the trouble and even make it progressively worse. This is particularly likely to occur when there is a large over-jet between the incisor teeth and the mandible must be protruded to its maximal extent when biting on the front teeth. In this position the condyle is no longer firmly supported on or behind the summit of the eminence and the joint structures are subjected to abnormal stress.

The condition may become a true luxation, or by weakening the attachment of disc to condyle may predispose to clicking of the first type described. Fortunately, the patient usually exercises sufficient care and avoids opening the mouth to its maximum extent and the progress of the condition is interrupted with, in some cases, a spontaneous return to normal.

TREATMENT

In Type I, should there be a normal free-way space treatment consists in a search for, and elimination of, causes of a "bite of comfort" or a misplaced tooth causing a forced deviation of the mandible as the teeth come into occlusion. This is usually not very difficult but in some cases it is worth while to adopt the procedure described by Lindblom (1948) which he calls "bite analysis". It should be pointed out, however, that success with this procedure is entirely dependent on the accurate registration of the rest position of the mandible.

In Type I cases with a large free-way space, treatment consists in making a bite splint or bite plane which prevents the mandible from closing more than 2 mm. beyond the rest position. In this way the forced backward movement of the mandible and condyles is prevented and in the majority of cases painless clicking is eliminated. It cannot be too strongly emphasized that this is not the same as bite-opening, the object is rather to fill in the abnormal free-way space and restore the mandible to its correct working position.

If the lower molars are missing a partial lower denture with extensions over the occlusal surfaces of the premolars can be used. If all the teeth are present the bite splint can be made

to cover the occlusal surfaces of the upper molars and premolars. Such an appliance is better tolerated in the upper jaw and it interferes less with speech. At the bite stage in the construction of the splint or denture measurements are made between marks on the face, or better still, on the incisor teeth when the mandible is in the rest position. The bite rims are built up and trimmed to give fairly uniform contact and to prevent closure beyond the rest position. Then with only the surface of the wax softened the patient closes, biting very lightly a further 2 mm. into the wax. The patient must be sitting comfortably and relaxed with the head unsupported. The bite rim must be replaced after cooling, and the closing movement repeated several times to make sure that each time the teeth pass exactly into the same position as they come into contact with the wax without any lateral deviation. If the clicking is not eliminated the procedure should be repeated allowing only $\frac{1}{2}$ to 1 mm. closure beyond the rest position. If, as sometimes happens, this still fails, or only partly succeeds in preventing clicking, one must on no account be tempted to build up the bite beyond the rest position as this may have disastrous results. The bite splint is processed in clear acrylic. A lingual or palatal bar is used to keep the appliance as small as possible. The occlusal surface of the splint is trimmed so that only a very shallow impression of the cusps of the opposing teeth remain. Such a bite splint should be worn all the time and on no account left out at night. If after being worn for several months the appliance has proved successful, the question of some more permanent prosthesis must be considered. Whether this takes the form of a removable denture or over-lay denture, or fixed bridges, it is as well to remove all misplaced tilted teeth from the opposing jaw, so that there is a reasonable chance of restoring a good articulation by making the prosthesis to replace these and other missing teeth, at the same time as the permanent replacement of the bite splint is made. This work is best carried out using an anatomical articulator with face-bow registration and using the temporary bite splint when mounting the study models in the centric position.

So far the treatment of only those cases with painless clicking and intermittent locking has been considered. It is among these that dental treatment has the best prospect of success. This is particularly encouraging when it is realized that this is the early stage of a process which if left unchecked may lead to a serious condition for which, in many cases, only surgical treatment offers relief and that not without risk. Whenever possible, therefore, the case should be tackled at this stage. It would be better still to spot what might be called the potential "clickers" before the symptoms start. Ideally, much could be done by well-planned orthodontic and prosthetic treatment to prevent a given individual from becoming even a potential case.

If a patient is seen shortly after the onset of painful limitation of movement, the third stage of Type I, it is worth while to attempt a manoeuvre such as that described by Pringle (1918) to reduce the displacement of the disc. A general anaesthetic may be needed for this. If this is successful the mandible should be immobilized in the rest position for about two weeks and then treated as a first or second stage case.

It should be mentioned here that at the onset of this condition the patient may experience the severest pain. It is one of the few instances among these conditions where a course of shortwave diathermy to the joint and muscles affords relief.

If the manoeuvre just mentioned is not successful in restoring normal movement or the condition has been present for some time, the first step is to construct a bite-splint in precisely the same way as that already described, but with a smooth occlusal surface. This will not only prevent the forced movement of overclosure, but will eliminate all lateral stress and allow the mandible to take up its new position as oedema within the joint settles down. In a proportion of cases this brings relief, and the patient becomes free from all except occasional pain and regains sufficient mobility in the joint to eat without undue difficulty. When this has been achieved the construction of a permanent appliance, on the lines already described, can be undertaken.

If after a reasonable trial of these measures, either the pain or the limitation of movement or both are unrelieved, surgical treatment must be contemplated.

The evaluation of the various forms of surgical treatment is beyond the scope of this paper; at the Maxillo-Facial Unit at East Grinstead, in cases of long standing, especially with severe limitation of movement or bony changes in the condyle, condylectomy has been found to give better results than extirpation of the disc. It is important to regain good movement in the false joint following condylectomy by using a training flange attached to a lower cast cap splint.

Extirpation of the disc probably has a place in the treatment of the early case, shortly after the onset of pain and limitation; but the tendency for symptoms to return with crepitation in the joint after some months or years cannot be ignored. In any case every effort must be made to establish a sound functional dental articulation after operation; not only to make the best of the new joint but to try to save the other joint from a similar fate.

For the Type II case—the acute traumatic arthritis—immobilization in the rest position, and a course of shortwave diathermy to the joint, ensure speedy relief from pain and a more certain and rapid restoration of normal function than if the mandible is left free. Alternatively, if the patient is not willing to have his jaw immobilized, a bite splint with a smooth occlusal surface may be used. The splint is worn only until the pain has gone.

In the third and last type of case—if the subluxation is of a mild degree no treatment, beyond an injunction to the patient that he must avoid opening his mouth to the full extent, may be necessary. If there is a marked over-jet of the incisor teeth it would be rational to correct this.

For the more severe case, there is a rather unattractive choice between several forms of surgical treatment and the use of a sclerosing agent injected into the joint. They all have as their objective the limitation of the forward gliding movement of the condyle, and they are all more or less successful in achieving this, whether it is by an osteoplastic operation to produce a bony stop on the summit of the eminence, or by dividing the attachment of the lateral pterygoid or by making a fascial sling around the joint. But when it is recalled that a simple arthrotomy also produces limitation of movement of the joint, it is clearly difficult to assess the merits of a particular operation.

The use of a sclerosing agent injected into the joint as described by Schultze (1937) has the merit of simplicity and freedom from the risk of injury to the facial nerve involved in any operative procedure on the joint. It cannot, however, be warmly recommended as it undoubtedly achieves its effect by causing an acute arthritis which results in adhesions within the joint as well as the peri-articular fibrosis claimed for it by the originators of this treatment.

In this paper the relatively common lesions of the temporo-mandibular joint have been considered. Only a brief reference has been made to the neurotic element which is often an important feature. Edentulous cases have not been dealt with separately, as they do not differ essentially from those discussed. The relatively rare cases of gradual limitation of movement in elderly patients with senile osteo-arthritic changes, and in younger patients with polyarthritis involving the temporo-mandibular joint, have not been considered.

I should like to express my indebtedness to the Nuffield Foundation which enabled me to visit the Scandinavian countries for studies on this subject. I am also deeply grateful to Sir William Kelsey Fry and Mr. Terence G. Ward for their help and encouragement in the preparation of this paper.

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Mr. R. S. Taylor: I have operated on a number of cases of clicking jaw that have not yielded to treatment on the lines described by Mr. Ireland. Of the 20 cases operated on since November 1948, 5 have been so recent that it is not possible to assess the results. Of the remaining 15 patients, 12 have shown definite improvement, and 3, little or no improvement. The operation performed was reinforcement of the capsule with a fascial strip, the object being to limit the excessive forward movement of the condyle. About one-third of the patients operated on were men.

It would be interesting to know what difference Mr. Ireland found as regards the incidence in the two sexes.

I do not think that trauma is by any means the only cause of clicking jaw, the condition is frequently seen in young people of poor muscle tone, and in middle-aged females of a neurotic type.

Mr. R. J. G. Grewcock: In his Address Mr. Ireland has dealt almost exclusively with temporo-mandibular derangement due to the *retruded* position of the condyle, omitting any mention of a protracted position with the teeth in occlusion.

I have in mind a patient giving evidence of much pain and crepitation in a joint in which X-rays showed the condyle to be eroded and antero-posed on the eminencia. Its fellow condyle was retroposed, and the joint without symptoms. Can Mr. Ireland tell us whether he has experience of similar derangement occurring as the result of advanced position of the condyle?

The relation between malocclusion and temporo-mandibular joint disorders has been closely investigated in Sweden and two main courses adopted for treatment. The *radical* method as exemplified by Karl Boman, who in his works published in 1947 describes the results obtained by extirpation of the disc in over a hundred cases. His conclusions lead him to state categorically that "clicking" in the joint is due to an overriding of the edge of the meniscus by the condyle, either anteriorly or posteriorly due to lack of concurrent traction of the disc during movement. Crepitation and clicking always cease following extirpation. Secondly, that repeated trauma as the result of malocclusion can often initiate temporo-mandibular joint disorders.

The *conservative* school, as supported by Lindblom, Beyron and others, prefers, quite naturally, to rely on bite analysis and any requisite bite adjustment, with restoration to the normal of the occlusal vertical dimension, before the rather serious operation of extirpation is even contemplated. From the many excellent results seen, I would make a plea for more intensive co-operation between

surgeon and dental surgeon in this country, to ensure that bite adjustment is tried before extirpation of the disc is attempted.

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Mr. Hamish Thomson: Why do some patients presenting with a temporo-mandibular joint disturbance show signs of a displaced bite while others with a similar bite displacement have no upset in the joint? Why do some joints which "click" during movement produce no pain while others do? What, broadly speaking, constitutes a "click" in the joint and what causes the pain? What, in other words, is the pathological process? Yet why in some joints which have "clicked" for years does there seem to be no such process? Some light may have been cast on these problems by Professor R. J. Last, who maintains that there is no pressure exerted by the condyle in the fossa during normal closure. Further, he states that not only is there no cartilage in the meniscus of the temporo-mandibular joint, but that it is a relatively vascularized tissue. It may be, then, that there is a possibility of tissue recovery following the trauma that may produce the disturbances under discussion.

With regard to treatment, there is no doubt that, in the majority of cases, by freeing the bite with a simple acrylic splint, and so resting the joint, symptoms and signs of joint disturbance disappear. The chief problem in the treatment of these cases is how to maintain the bite at the new height. A warning as to the effect of prosthetic treatment of the bite, in relation to the joint, may be worth while, and may point to the limitation of this line of treatment. The muscles which maintain the jaws and provide their functional force tend to restore the bite to its original position at the expense of the investing tissues of the teeth. Care should be taken that too optimistic an alteration in the bite height is not made and that due regard be paid to the rest position of the mandible. This may point, in turn, to the part played by the musculature in disturbances of the joint. J. R. Thompson (Chicago) has suggested to me that a neuromuscular imbalance may be a factor in these disturbances.

Mr. C. F. Ballard: I would like to correct one impression that Mr. Ireland has given. A normal incisor contact is not a sliding one, and therefore whatever happens to the vertical dimension in the buccal segments a sliding contact is not going to produce distal displacement of the mandible. Mutilation of the buccal segments may, of course, be followed—and frequently is—by a change in the incisor occlusion. However, abnormal incisor relationship due to abnormal axial inclination of the teeth, or due to abnormal dental base relationship (the first may follow early loss of deciduous teeth), may result in a sliding contact which, through sensory stimulation, might produce a posterior displacement of the mandible. The sliding contacts associated with excessive overbite of typical Angle's Class II, Division 2, abnormalities, and some Angle's Class II, Division 1, abnormalities, have again no relationship to the vertical dimension of the dento-alveolar structures in the buccal segments. They are the result of abnormal axial inclination of the teeth associated perhaps, but not always, with abnormal dental base relationship. There is a possible explanation of the mechanism of posterior displacement in the fact that we know that the posterior horizontal fibres of the temporal muscle are used for retraction of the mandible. It might be argued that in these sliding contacts either in incisor and canine region, or in premolar region, sensory, including proprioceptive, stimulus causes a reflex contraction of the posterior fibres and some of the vertical fibres of the temporal muscle just when, in fact, the muscles should be reflexly relaxing as the teeth come into occlusion. This contraction would not only produce a posterior displacement but would also account for the excessive free-way space which is so frequently seen in these cases. It disturbs the normal balance between the main muscles of mastication at the time of occlusion and the vertical development of the dento-alveolar structures in favour of the former, so balancing the development of the latter at what is a true overclosed position. It is important to remember that in the normal, vertical development of the dento-alveolar structures is in physiological balance with muscle action. Any disturbance of occlusion might reflexly disturb muscle action, alter this delicate balance and produce joint symptoms.

Mr. Ireland, in reply, stated that about two-thirds of his cases were women.

He had encountered two cases resembling the one mentioned by Mr. Grewcock. In these, the position of the condyle was normal but the clinical features suggested that the disc or part of the disc was behind the condyle. The mandible deviated to the opposite side on opening, and lateral movement towards the affected side increased the pain.

He stressed the fact that observations of the mechanism of clicking during operations on the joint, or by contrast arthrography, were often misleading. Apart from the difficulty of such observations because of the inaccessibility of the joint the operative interference itself, whether under local or general anaesthesia, completely altered working conditions of the joint.

In reply to Mr. Hamish Thomson he agreed that there is probably no pressure exerted on the condyle in the normal joint, at least when biting on the posterior teeth, and considered this an added reason why pathological changes occur when the joint is subjected to pressure associated with the various dental factors discussed.

The fact that many of the early cases of clicking do respond to the simple measures advocated lent support to the view that the tissues of the joint are capable of recovery.

In reply to Mr. Ballard he considered that it is the further closing of the bite following loss of buccal teeth in cases of Angle's Class II, Division 2, which is responsible for posterior displacement of the mandible, the inclined planes of the incisor acting either directly or possibly by a reflex mechanism as suggested by Mr. Ballard.